

1 1. A guide device for locating a working axis substantially normal with respect to an  
2 articular surface of bone, said device comprising:

3 a shaft having an end and an aiming feature for projecting an axis; and

4 a contact surface comprising a plurality of points radially extending from the  
5 aiming feature of said shaft;

6 wherein said plurality of points of said contact surface surrounds a defect in an  
7 articular surface.

8 2. A guide device as claimed in claim 1, wherein said contact surface is formed by a  
9 generally toroidal member coupled to the end of said shaft.

10 3. A guide device as claimed in claim 1, wherein said contact surface comprises at  
11 least one fin, projection, or deformable element.

12 4. A guide device as claimed in claim 1, wherein said shaft is cannulated, and  
13 wherein said guide device is adapted to receive a tool for creating a pilot hole through  
14 said cannulated shaft and permit said tool to be driven substantially normal into an  
15 articular surface of bone when at least three of said plurality of points of said contact  
16 surface make contact with said articular surface of bone.

17 5. A guide device as claimed in claim 1, wherein said guide device is adapted to  
18 receive a guide pin or wire through said aiming feature and permit said guide pin or wire  
19 to be driven substantially normal into an articular surface of bone when at least three of  
20 said plurality of points of said contact surface make contact with said articular surface of  
21 bone.

1 6. A guide device as claimed in claim 1, wherein said contact surface comprises at  
2 least one aperture or transparent portion formed therein, permitting the viewing of at least  
3 a portion of an articular surface therethrough.

4 7. A guide device as claimed in claim 1, wherein said plurality of points of said  
5 contact surface corresponds to the plurality of points making contact with an articular  
6 surface along the perimeter of an implant.

7 8. A guide device as claimed in claim 1, wherein said plurality of points of said  
8 contact surface corresponds to the plurality of points along the perimeter of a portion of  
9 an articular surface to be removed.

10 9. A guide device for locating a working axis substantially normal with respect to an  
11 articular surface of bone, said device comprising:

12 a shaft having an aiming feature for projecting an axis; and

13 a contact surface comprising a plurality of points radially equidistant from the aiming  
14 feature of said shaft.

15 10. A guide device for locating a working axis substantially normal with respect to an  
16 articular surface of bone, said device comprising:

17 a shaft having an aiming feature for projecting an axis; and

18 a contact surface comprising a plurality of points equidistant from the aiming feature of  
19 said shaft.

1 11. A guide device for locating a working axis substantially normal with respect to an  
2 articular surface of bone, said device comprising:

3 a shaft having an end and a central longitudinal axis; and

4 a contact surface comprising a plurality of points radially equidistant from said  
5 central longitudinal axis.

6 12. A guide device for locating a working axis substantially normal with respect to a  
7 non-spherical articular surface of bone, said device comprising:

8 a first element having a longitudinal axis and a contact surface mounted to a shaft;

9 and

10 a second element with a contact surface movable with respect to the contact  
11 surface of the first element, wherein, when said guide device is placed on a non-spherical  
12 articular surface, both contact surfaces make contact with said articular surface.

13 13. A guide device as claimed in claim 12, wherein each said contact surface  
14 comprises a plurality of arcuate sections of a generally toroidal member, wherein said  
15 generally toroidal member is formed when said contact surfaces make contact with a  
16 locally spherical articular surface.

17 14. A guide device as claimed in claim 12, wherein one said contact surface is biased  
18 in one direction with respect to the other said contact surface.

19 15. A guide device as claimed in claim 12, wherein said contact surfaces are adapted  
20 such that the contact surface of the first element make contact with a plurality of points  
21 along either one of the AP or ML curves of an articular surface, while the contact surface

1 of said second element make contact with a plurality of points along the other of the AP  
2 or ML curves of said articular surface.

3 16. A guide device as claimed in claim 12, wherein said first or said second element  
4 comprises a cannula, wherein said guide device is adapted to receive a tool for creating a  
5 pilot hole through said cannula and permit said tool to be driven substantially normal into  
6 an articular surface of bone.

7 17. A guide device as claimed in claim 12, wherein said first or said second element  
8 comprises a cannula, wherein said guide device is adapted to receive a guide pin or wire  
9 through said cannula and permit said guide pin or wire to be driven substantially normal  
10 into an articular surface of bone.

11 18. A guide device as claimed in claim 12, wherein said first or said second element  
12 comprises at least one aperture or transparent portion formed therein, permitting the  
13 viewing of at least a portion of an articular surface therethrough.

14 19. A guide device as claimed in claim 12, wherein the outermost dimensions of said  
15 contact surfaces surround a defect in an articular surface.

16 20. A guide device as claimed in claim 15, wherein the plurality of points contacting  
17 said contact surfaces corresponds to the plurality of points abutting an articular surface  
18 along the perimeter of an implant.

19 21. A guide device as claimed in claim 15, wherein the plurality of points contacting  
20 said contact surfaces corresponds to the plurality of points along the perimeter of a  
21 portion of an articular surface to be removed.

1 22. A guide device for locating a working axis substantially normal with respect to an  
2 articular surface of bone having an anterior-posterior (AP) curve and a medial-lateral  
3 (ML) curve, said device comprising:

4 a cannulated outer shaft, said outer shaft having a central longitudinal axis and an  
5 outer component at its distal end, said outer component comprising a set of arms; and

6 a cannulated inner shaft slidably disposed within the cannula of said outer shaft,  
7 said inner shaft having an inner component at its distal end and sharing the central  
8 longitudinal axis of said outer shaft, said inner component comprising a set of arms.

9 23. A method for replacing a portion of an articular surface of bone, said method  
10 comprising:

11 establishing a working axis substantially normal to an articular surface of bone;

12 excising only a portion of said articular surface adjacent said axis, thereby  
13 creating an implant site; and

14 installing an artificial implant into said implant site.

15 24. A method as claimed in claim 23, wherein said implant comprises a bone-facing  
16 distal surface adapted to mate with said implant site, said surface comprising at least one  
17 mating feature; and a proximal surface having a contour substantially matching or based  
18 on the original surface contour of said excised portion of said articular surface.

19 25. A method as claimed in claim 24, wherein said mating feature is selected from the  
20 group consisting of: barbs, threads, ribs, fins, milled slots, tapered distal features, features

1 to prevent rotational movement of said implant, or features to increase friction and/or  
2 contact surface between said implant and the aperture at said implant site.

3 26. A method for replacing a portion of an articular surface of bone, said method  
4 comprising:

5 establishing a working axis substantially normal to an articular surface of bone;

6 excising only a portion of said articular surface adjacent said axis, thereby  
7 creating an implant site;

8 selecting an implant corresponding to the dimensions of said implant site from a  
9 set of variously-sized implants; and

10 installing said selected implant into said implant site.

11 27. A method as claimed in claim 26, wherein said establishing step is performed  
12 using a tool comprising a shaft having an aiming feature and a distal surface comprising a  
13 plurality of points radially extending from said aiming feature.

14 28. A method as claimed in claim 26, wherein said implant comprises a bone-facing  
15 distal surface adapted to mate with said implant site, said surface comprising at least one  
16 mating feature; and a proximal surface having a contour substantially matching or based  
17 on the original surface contour of said excised portion of said articular surface.

18 29. A method as claimed in claim 28, wherein said mating feature is at least one of  
19 the features selected from the group comprising: barbs, threads, ribs, fins, milled slots,  
20 tapered distal features, features to prevent rotational movement of said implant, or  
21 features to increase friction between said implant and the aperture at said implant site.

- 1     30.     A method as claimed in claim 26, wherein said establishing step is performed  
2     using a tool comprising a shaft having an end and an aiming feature; and at least one  
3     contact surface coupled to the end of said shaft, said contact surface comprising a  
4     plurality of points radially extending from said aiming feature.
- 5     31.     A method as claimed in claim 26, wherein said establishing step is performed by  
6     installing a guide pin or wire into said articular surface along said axis.
- 7     32.     A method as claimed in claim 26, wherein said excising step is performed using a  
8     cutting tool that rotates about said axis.
- 9     33.     A method as claimed in claim 26, wherein said installing step comprises driving a  
10    fixation element into said articular surface along said axis.
- 11    34.     A method as claimed in claim 33, wherein said fixation element comprises a  
12    mating feature at its proximal end.
- 13    35.     A method as claimed in claim 33, wherein said fixation element comprises a  
14    screw.
- 15    36.     A method as claimed in claim 34, wherein said fixation element is adapted to  
16    mate, position, or align with an element adapted to aid in the depthwise positioning of  
17    said fixation element with respect to said articular surface.
- 18    37.     A method as claimed in claim 34, wherein said mating feature is adapted to mate,  
19    position, or align with the distal portion of an implant.
- 20    38.     A method as claimed in claim 37, wherein said mating feature is adapted to  
21    prevent movement of said implant with respect to said fixation element.

1     39.     A method as claimed in claim 33, wherein said fixation element comprises a  
2     tapered distal feature and/or aggressive distal threads.

3     40.     A method for replacing a portion of an articular surface of bone generally defined  
4     by a first and a second curve, said method comprising:  
5             establishing an axis generally normal to the portion of an articular surface of bone  
6     to be replaced based on a first curve and a second curve of said articular surface;  
7             excising only a portion of said articular surface adjacent said axis, thereby  
8     creating an implant site;  
9             fabricating an artificial implant corresponding to the dimensions of said implant  
10    site; and  
11            installing said artificial implant into said implant site.

12    41.     A method as claimed in claim 40, wherein said implant comprises a bone-facing  
13    distal surface adapted to mate with said implant site, said surface comprising at least one  
14    mating feature; and a proximal surface having a contour substantially matching or based  
15    on the original surface contour of said excised portion of said articular surface.

16    42.     A method as claimed in claim 41, wherein said mating feature is selected from the  
17    group consisting of: barbs, threads, ribs, fins, milled slots, tapered distal features, features  
18    to prevent rotational movement of said implant, or features to increase friction between  
19    said implant and the aperture at said implant site.

20    43.     A method for replacing a portion of an articular surface of bone generally defined  
21    by a first and a second curve, said method comprising:



1           establishing an axis generally normal to the portion of an articular surface of bone  
2   to be replaced based on a first curve and a second curve of said articular surface;  
  
3           excising only a portion of said articular surface adjacent said axis, thereby  
4   creating an implant site;  
  
5           selecting from a set of variously-sized artificial implants an artificial implant  
6   corresponding to the dimensions of said implant site; and  
  
7           installing said selected implant into said implant site.

8   44.    A method as claimed in claim 43, wherein said first and second curves are  
9   anterior-posterior (AP) and medial-lateral (ML) curves.

10   45.   A method as claimed in claim 43, wherein said excising step is performed by  
11   cutting at least a portion of said articular surface radially symmetrically about said axis.

12   46.   A method as claimed in claim 43, wherein said implant comprises a bone-facing  
13   distal surface adapted to mate with said implant site, said surface comprising at least one  
14   mating feature; and a proximal surface having a contour substantially matching or based  
15   on the original surface contour of said excised portion of said articular surface.

16   47.   A method as claimed in claim 46, wherein said mating feature is selected from the  
17   group consisting of: barbs, threads, ribs, fins, milled slots, tapered distal features, features  
18   to prevent rotational movement of said implant, or features to increase friction between  
19   said implant and the aperture at said implant site.

20   48.   A method as claimed in claim 43, wherein said establishing step is performed  
21   using a tool comprising a first element having an aiming feature and a contact surface

1 mounted to a shaft, and a second element with a contact surface movable with respect to  
2 the contact surface of the first element, wherein, when said tool is placed on a non-  
3 spherical articular surface, both contact surfaces make contact with said articular surface.

4 49. A method as claimed in claim 43, wherein said establishing step is performed by  
5 installing a guide pin or wire into said articular surface along said axis.

6 50. A method as claimed in claim 43, wherein said excising step is performed using a  
7 cutting tool that rotates about said axis.

8 51. A method as claimed in claim 43, wherein said installing step comprises driving a  
9 fixation element into said articular surface along said axis.

10 52. A method as claimed in claim 51, wherein said fixation element comprises a  
11 mating feature at its proximal end.

12 53. A method as claimed in claim 51, wherein said fixation element comprises a  
13 screw.

14 54. A method as claimed in claim 52, wherein said mating feature is adapted to mate,  
15 position, or align with an element adapted to aid in the depthwise positioning of said  
16 fixation element with respect to said articular surface.

17 55. A method as claimed in claim 52, wherein said mating feature is adapted to mate  
18 with the distal portion of an implant.

19 56. A method as claimed in claim 55, wherein said mating feature is adapted to  
20 prevent movement of said implant with respect to said fixation element.

- 1 57. A method as claimed in claim 51, wherein said fixation element comprises a  
2 tapered distal feature and/or aggressive distal threads.
- 3 58. A tool for holding an implant, said tool comprising:  
4 at least one element adapted for connection to an activatable suction source; and  
5 an elastomeric suction tip adapted to receive an implant, said tip being coupled to  
6 said at least one element.
- 7 59. A tool as claimed in claim 58, further comprising a rigid tip disposed within the  
8 elastomeric suction tip, whereby a force in the direction of the delivery site of said  
9 implant permits said rigid tip to contact said implant while said implant is being held by  
10 said suction tip.
- 11 60. A method for holding an implant comprising:  
12 coupling a suction source to an implant; and  
13 activating said suction source.
- 14 61. A method for delivering an implant comprising:  
15 coupling an active suction source to an implant;  
16 approximating said implant to its delivery site; and  
17 applying a force to said implant in the direction of said delivery site.
- 18 62. A tool for removing an implant from its delivery site, said tool comprising:

1           an element with a generally leading edge and a barb element disposed proximally  
2   to the leading edge; and

3           at least one structural element that creates sufficient bias of the leading edge of  
4   the tool to rigidly couple to a surface of the implant to be removed.

5   63.    A tool as claimed in claim 62, further comprising means for coupling said tool to  
6   a slap hammer or slide hammer capable of applying a pulling force to an implant held at  
7   said barb element.

8   64.    A tool for removing an implant from its delivery site, said tool comprising:

9           a cylindrical structure having an end; said end comprising a longitudinal central  
10   axis, a circular blade portion having a leading edge comprising a blade surface turned on  
11   the distal-most portion, and a lip portion disposed proximally with respect to the leading  
12   edge; and

13          a plurality of slits parallel to the longitudinal central axis of said end formed along  
14   the length of said cylindrical structure, so as to permit sufficient outward expansion of the  
15   distal end to accommodate the top edge of an implant therein.

16   65.    A tool as claimed in claim 64, further comprising means for coupling said tool to  
17   a slap hammer or slide hammer capable of applying a pulling force to an implant held in  
18   said distal end.

19   66.    A method for removing an implant from its delivery site, said method comprising:

20          disposing the lip portion of the leading edge of the end of a removal tool over the  
21   upper edge of an implant seated in its delivery site; and

1           applying a pulling force to said removal tool.

2   67.    A method as claimed in claim 66, wherein said pulling force is applied using a  
3   slap hammer or slide hammer.

4   68.    A device for measuring a portion of an articular surface of bone, said device  
5   comprising:

6           a handpiece;

7           a shaft disposed within said handpiece, said shaft comprising a feature for  
8   aligning with a working axis or mating to a fixed element;

9           a contact tip moveably coupled to said shaft; and

10          at least one measuring element coupled to said contact tip or said shaft.

11   69.    A device as claimed in claim 68, further comprising recording means for  
12   recording measurements taken by said at least one measuring element.

13   70.    A device as claimed in claim 69, wherein translation and/or rotation of the contact  
14   tip with respect to the handpiece or shaft causes said at least one measuring element to  
15   measure travel of the contact tip, and the recording means to record at least one  
16   measurement taken by at least one said measuring element.

17   71.    A device as claimed in claim 70, further comprising machine-readable code to  
18   analyze said at least one recorded measurement and output to a user the dimensions of an  
19   implant to be used in said articular surface.

1    72.    A device as claimed in claim 70, further comprising machine-readable code to  
2    analyze said at least one recorded measurement and compare said measurement to at least  
3    one previously taken measurement.

4    73.    A device as claimed in claim 70, further comprising machine-readable code to  
5    analyze said at least one recorded measurement, select an implant corresponding to said  
6    at least one measurement from a set of variously-sized implants, and output to a user said  
7    selection.

8    74.    A device for mapping a portion of an articular surface of bone, said device  
9    comprising:

10            a handpiece;

11            an inner shaft running along the length of and disposed within said handpiece,  
12    said inner shaft comprising a mating feature for mating with a fixed element located  
13    substantially normal with respect to an articular surface;

14            a contact tip slidably and rotatably disposed about said inner shaft;

15            a rotary measuring element coupled to and rotating with said contact tip; and

16            a linear measuring element nested concentrically and coaxially to said rotary  
17    measuring element, and coupled to and moving linearly with said contact tip.

18    75.    A device as claimed in claim 74, further comprising recording means for  
19    recording measurements taken by said measuring elements.

1    76.    A device as claimed in claim 75, wherein translation and/or rotation of the contact  
2    tip with respect to the handpiece or shaft causes said measuring elements to measure  
3    travel of the contact tip, and the recording means records measurements taken by the  
4    measuring elements simultaneously, when the mating feature of said inner shaft is mated  
5    with said fixed element and/or said contact tip is fixably aligned to a working axis.

6    77.    A device as claimed in claim 76, further comprising machine-readable code to  
7    analyze said recorded measurements and output to a user the dimensions of an implant to  
8    be used in said articular surface.

9    78.    A device as claimed in claim 76, further comprising machine-readable code to  
10    analyze said recorded measurements, select an implant corresponding to said  
11    measurements from a set of variously-sized implants, and output to a user said selection.

12    79.    A set of guide devices for locating a working axis substantially normal with  
13    respect to an articular surface of bone or for determining the dimension of an implant to  
14    be installed in an articular surface of bone, said set comprising:

15            a plurality of variously dimensioned guide devices, each said guide device having  
16    a handling tab or shaft and a contact surface; said contact surface comprising a plurality  
17    of points radially extending from said handling tab or shaft; wherein, when at least one  
18    said guide device is placed on an articular surface, said contact surface makes contact  
19    with said articular surface, and said plurality of points of said contact surface surrounds a  
20    defect in said articular surface.

21    80.    A set of guide devices as claimed in claim 79, wherein said plurality of points of  
22    at least one said guide device do not all lie in the same plane.